

The Value of the Fourth Year of Mathematics

Too many students and educators view the senior year and graduation from high school as an end point, rather than one vital step along the education pipeline. Students who engage in a fourth year of math tap into and build upon their advanced analytic skills and are more likely to have better success in postsecondary course work, as they have maintained their momentum and continued to practice mathematics throughout their high school experience.

Math is a continuum of learning.

- Researchers who study learning and cognition describe mathematical learning as a progression in which conceptual understanding builds logically, and expertise is developed gradually.¹
- When students are not directly engaged in instruction, they suffer a learning loss. Just over an average summer, students lose approximately 2.6 months of grade-level equivalency in mathematics.² The learning loss during a student's senior year similarly has the potential to be very significant.
- Additionally, 67 percent of middle school teachers rank math as the single most difficult subject for students to re-engage in when returning to school after the summer break and 50 percent claimed that students' math skills regress the most, compared to other subjects, during that time off.³
- All students gain more advanced math skills later in high school, but the most significant gains are found among students who take rigorous math during their junior and senior years. The largest learning gains made in advanced skill proficiency—such as complex multi-step analysis—were among students who took pre-calculus and another course during 11th and 12th grade. The largest gains in intermediate math skills—such as simple operations and problem solving—were made by students who took Geometry and Algebra II during the last two years of high school.⁴
- Unsurprisingly, the smallest gains at all proficiency levels were made among students who took no math or only one math course during 11th and 12th grade.⁵

FOURTH YEAR MATH ALTERNATIVES

Many students who complete a three-course sequence, such as Algebra I, Geometry, and Algebra II, go on to take Pre-Calculus and Calculus. Yet, for those students who choose not to follow that track, there need to be options for fourth year courses that include rich and meaningful mathematics. Students not intending to pursue math-intensive majors should be able to select from a number of fourth year "capstone" courses to maintain and extend their prior mathematical knowledge and connect mathematics instruction with other interests. Effective capstone courses can keep students engaged in learning and ensure a smoother transition into postsecondary education and the workplace.¹⁰

A fourth year of math improves students' college readiness.

- A recent report from ACT finds that a fourth year of math is associated positively with students' college readiness. While only 16 percent of students taking three years of math met the readiness benchmarks on the ACT in math, 62 percent of students taking four years, and 75 percent of students taking four and a half years of math met that benchmark.⁶
- Similarly, on average, students with four years of high school math score 63 points higher on the SAT-I quantitative section than students with only three years of math. Students who take more than four years of math, such as students who complete Algebra I in middle school, score 52 points higher on the SAT-I quantitative section than students with exactly four years of math.⁷
- In one study of students from three states who had taken the ACT, 26 percent of students who took three years of math in high school (including Algebra, Geometry and Algebra II) required remediation upon entering college, while taking a fourth year of advanced math reduced the remediation rate to 17 percent.⁸
- 74 percent of recent high school graduates surveyed believe that requiring four years of math and science would have better prepared them for life after high school. Additionally, about 80 percent of graduates say they would have worked harder had their high schools demanded more of them.⁹

ENDNOTES

- 1 NRC, 2005 www.nap.edu/openbook.php?record_id=11101&page=43
- 2 Cooper, Harris et al [1996]. *The Effects of Summer Vacation on Achievement Test Scores: A Narrative and Meta-Analytic Review*. Review of Educational Research, v66 n3 p227-68 Fall 1996.
- 3 The Raytheon MathMovesU Back-to-School Survey, Nov 2006.
- 4 Bozick, R., and Ingels, S.J. (2008). *Mathematics Coursetaking and Achievement at the End of High School: Evidence from the Education Longitudinal Study of 2002*. [NCES 2008-319]. Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- 5 Bozick, R., and Ingels, S.J. (2008). *Mathematics Coursetaking and Achievement at the End of High School: Evidence from the Education Longitudinal Study of 2002*. [NCES 2008-319]. Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- 6 ACT, Inc. (2007). *Rigor At Risk: Reaffirming Quality in the High School Core Curriculum*. www.act.org/research/policymakers/pdf/rigor_report.pdf
- 7 College Board. (2006). *2006 College-Bound Seniors Total Group Profile Report*. www.collegeboard.com/prod_downloads/about/news_info/cbsenior/yr2006/national-report.pdf.
- 8 ACT, Inc. (2007). *Rigor At Risk: Reaffirming Quality in the High School Core Curriculum*. www.act.org/path/policy/pdf/rigor_report.pdf
- 9 Peter D. Hart Research Associates/Public Opinion Strategies. (2005). *Rising to the Challenge: Are High School Graduates Prepared for College and Work?* Washington, DC: Achieve.
- 10 To see examples of fourth year capstone courses, see www.utdanacenter.org/k12mathbenchmarks/resources/capstone.php